# DESERT CONSERVATION PROGRAM RARE PLANT INVENTORIES

# FINAL PROJECT REPORT

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# Acronyms and Abbreviations

| | |
|---|---|
| DCP | Desert Conservation Program |
| GPS | global positioning system |
| GIS | geographic information system |
| ICF | ICF Jones & Stokes |
| OHV | off-highway vehicle |

Desert Conservation Program Rare Plant Inventories

# Final Project Summary Report

## Executive Summary

Surveys for ten rare plant species (Table 1) were conducted for the Clark County Desert Conservation Program (DCP) at 511 survey sites in Clark County, Nevada.

**Table 1. Target Rare Plants**

| Scientific Name | Common Name |
|---|---|
| *Anulocaulis leisolenus* | Sticky ringstem |
| *Arctomecon californica* | Las Vegas bearpoppy |
| *Arctomecon merriamii* | White bearpoppy |
| *Astragalus geyeri* var. *triquetrus* | Threecorner milkvetch |
| *Eriogonum bifurcatum* | Pahrump Valley buckwheat |
| *Eriogonum corymbosum* var. *nilesii* | Las Vegas buckwheat |
| *Eriogonum viscidulum* | Sticky buckwheat |
| *Pediomelum castoreum* | Beaver Dam breadroot |
| *Penstemon albomarginatus* | White margined beardtongue |
| *Penstemon bicolor* ssp. *bicolor* | Yellow two-tone beardtongue |

The surveys were conducted between April 2009 and May 2010 using standardized data collection protocols, and resulted in the observation of a total of 98 rare plant locations. All target plant species were observed at least once. Las Vegas bearpoppy was the most commonly observed target species with 31 observations, and white-margined beardtongue was the least, observed only once. A majority of the observations were made within the survey plots, however approximately 30% of all observations were incidental (i.e., the observations were made traveling to or leaving the survey plot). Many of the target species are perennial and/or have distinctive habitats and/or growth forms; factors that make the survey results very reliable. The remaining annual species are known to be highly dependent on the timing and abundance of rainfall. Rainfall during the spring of 2009 and 2010 was close to normal and all the annual species were evident at reference locations, indicating the results of the surveys should also be reliable for annual species.

# Introduction

Under contract with the DCP, ICF Jones & Stokes (ICF) conducted surveys for ten rare plant species in Clark County, Nevada. The goal of the surveys was to determine the presence or absence of the ten species and to identify the habitat characteristics at 511 specified survey plots in thirteen Geographic Units (Figure 1 and Table 2). The surveys were designed to obtain new location and ecological information on the species to further define their predictive ecological models. This document describes the methods and resources necessary to complete the survey project and summarizes the results of the surveys.

**Table 2. Geographic Units and Number of Survey Plots**

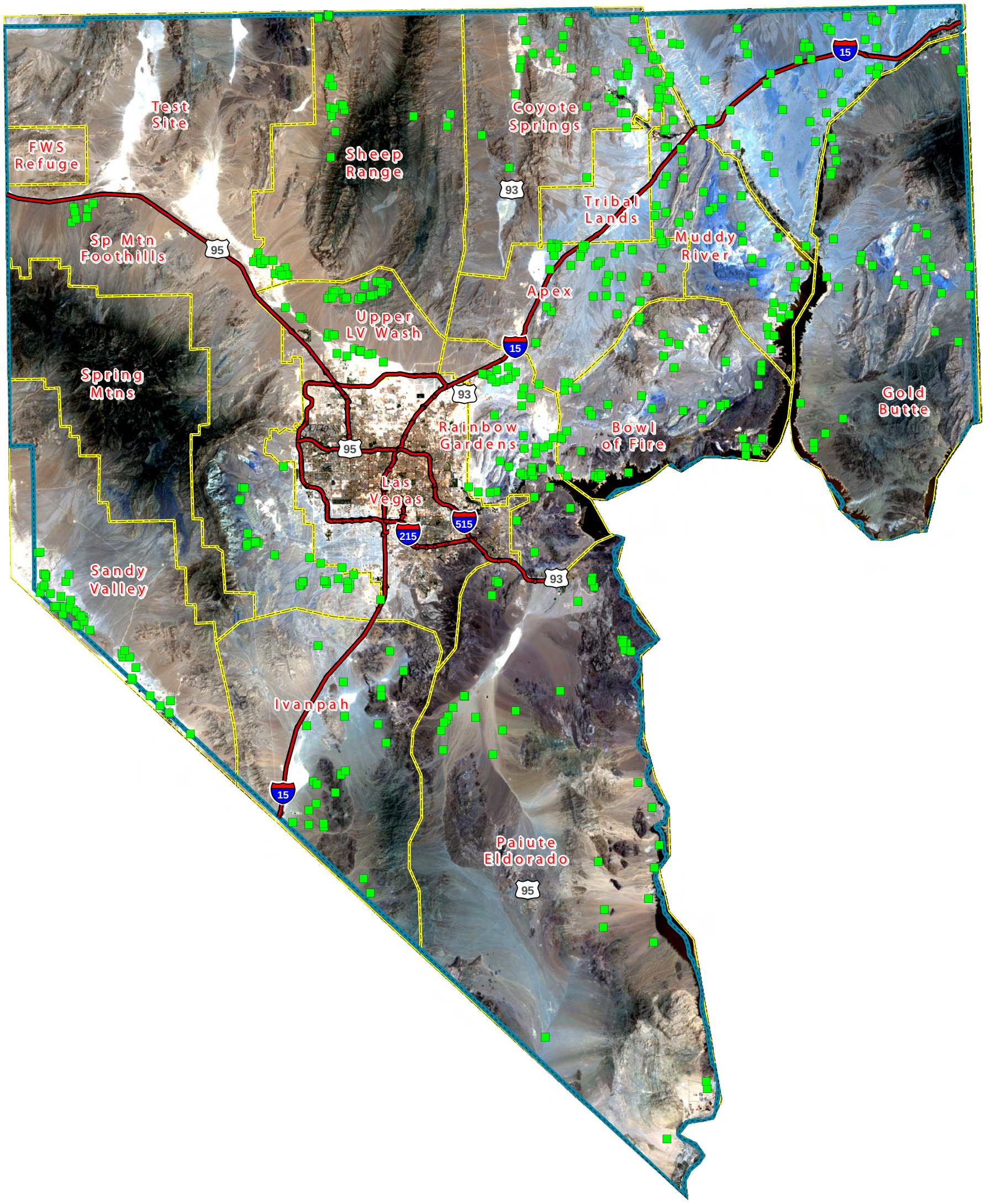
| Geographic Unit Name | Number of Survey Plots |
|---|---|
| Apex | 40 |
| Bowl of Fire | 41 |
| Coyote Springs | 44 |
| Gold Butte | 33 |
| Ivanpah | 25 |
| Mormon Mesa | 44 |
| Muddy River | 44 |
| Paiute Eldorado | 40 |
| Rainbow Gardens | 41 |
| Sandy Valley | 44 |
| Sheep Range | 32 |
| Spring Mountain Foothills | 39 |
| Upper LV Wash | 44 |

# Methodology

## Overview

The DCP developed a predictive ecological model for ten rare plant species. Based on the parameters of that model, a total of 511 four-hectare (approximately ten acre) sites were randomly selected for the survey by the DCP project manager. Sites were generally screened for accessibility (ensuring proximity to a road or trail) and appropriateness. Several replacement sites were issued during the project when access was not possible.

A standardized field survey protocol and Work Plan (ICF Jones & Stokes 2009a) were developed prior to starting the project. The field survey protocol included standardized field data forms (developed specifically for the project), a custom Global Positioning System (GPS) data dictionary, and instructions for interpreting and recording ecological information. Information collected in the data dictionary and on field survey forms included standard survey information such as the names of the surveyors, the survey plot number, the date, etc. Additional information on dominant and associate plant species, soils, minimum and maximum slope, threats, population size, aspect, and the




Sample Plots
Freeway
County Boundary
Geographic Units

1 inch = 60,000 feet

0 10 20
Miles

N

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**Figure 1**
**Geographic Units and Survey Plot Locations**

presence of invasive plant species was also recorded. The Work Plan (ICF Jones & Stokes 2009) prepared for the project described all of the information to be collected and described the appropriate interpretation of each item.

Training sessions were held in early April 2009, prior to beginning surveys, to ensure that all personnel were recording information in a similar manner and according to the standardized protocol. Field SurveysTeams of botanists (typically 2 botanists per team) conducted field surveys beginning in April 2009. Teams approached each survey plot as close as possible using open roads, and then traveled on foot to each survey plot. A Trimble Geo-XT or Geo-XM GPS unit, loaded with the project specific data dictionary, was assigned to each survey team. Data collected during the surveys was recorded using the Trimble GPS units as well as on paper field data forms (which mirrored the information collected in the GPS data dictionary). Teams recorded their survey route to and from each plot (their "tracks"), any of the target rare plant species encountered within and outside of the survey plot, as well as photographs of each survey plot.

In general, the teams navigated from the closest public road to a corner of a plot and then surveyed the plot systematically using transects spaced approximately 30 feet apart. Where topography did not allow 30-foot transect spacing, the teams surveyed with the topography, covering the entire survey plot to a sufficient level of detail to ensure detection of any target plant species within the plot. Each team tracked their survey route (going to the survey plot and coming back from it) using the “between feature tracking” setting on the GPS unit, a feature which records the position of the unit at all times, and allows production of an accurate survey map. In addition to completing the GPS data dictionary at each survey site, data was recorded on field data forms. Additionally, the teams recorded representative photographs of each survey plot. Incidental occurrences of target rare plant species (i.e., observations made while traveling to or back from a survey plot) were recorded in addition to any occurrences within the boundaries of the 511 survey plots.

## Survey Prioritization

The survey plots were located throughout Clark County at various elevations, aspects, and soil types. In order to survey each of the plots during the appropriate time to detect the target species with the highest potential to occur, the surveys were prioritized according to the criteria listed below in order of priority.

- Observed blooming period of target plants in the surrounding region. Blooming periods were determined through visits to known populations and through consultations with Clark County (who consulted with other individuals and land managers including BLM or NPS personnel). In general, annuals and short-lived perennials were targeted first, followed by perennial species.
- Type of survey plot (i.e., sand or gypsum). In general, sand survey plots were completed first.
- Elevation. In general, lower elevation survey plots were completed first.

In general, the survey teams worked in different geographic units during each survey rotation in order to maximize the chances of locating target species as they were blooming and/or identifiable. The ICF Jones & Stokes Project Manager consulted the County Project Manager prior to the start of each survey crew rotation regarding the appropriate survey plots for the period.

# Data Collection

As discussed above, data was collected within survey plots but also incidentally on the way to or from the survey plots.

## Survey Plots

Each survey plot was surveyed by a team comprising one lead botanist and one assistant botanist. In general, the team would navigate to a corner of a plot and would survey the plot systematically using transects spaced approximately 30 feet apart. Where topography did not allow 30-foot transect spacing, the teams surveyed with the topography, covering the entire survey plot to ensure detection of any target plant species within the plot. For survey plots identified by Clark County as "visual observation only," surveys were conducted by covering as much of the area as the topography allowed. Areas that were not accessible were scanned from a distance using binoculars. Each team was assigned one Trimble GPS unit and tracked its survey routes using the "between feature tracking" setting on the GPS unit, both during the survey and while travelling to and from the plot.

Following completion of each survey plot, the team recorded data on the survey plot on field data forms and using the data dictionary. Additionally, the team took a representative photograph of the survey plot. The following data was recorded at each survey plot.

- **Date of Field Work**: Date the plot was surveyed.
- **Approximate Time:** Approximate time the plot was surveyed. Recorded concurrently with the GPS data file.
- **Survey Plot Number:** Unique number assigned to each survey plot by Clark County.
- **Botanist Names:** Names of the Lead Botanist and Assistant Botanist.
- **Geographic Unit:** Unique name assigned to each geographic unit by Clark County.
- **Target Species Observed:** List of target species observed within the plot.
- **General Aspect:** General aspect of the plot as a whole.
- **Minimum Slope:** Minimum slope within the entire survey plot.
- **Maximum Slope:** Maximum slope within the entire survey plot.
- **Cryptogammic Crust:** Presence or absence of cryptogammic crust. Marked as "present" if crust is present within 33% or more of the survey plot.
- **Threats/Disturbance:** Presence of roads (paved or gravel), trails (animal or human), Off-Highway Vehicle (OHV) activity, dumping and trash (landscape-level accumulations rather than individual items), and evidence of fire (landscape-level fires).
- **Vegetation Composition:** Dominant species, co-dominant species (if any are co-dominant), and associate species.
- **Indicator Species:** Presence or absence of seven indicator species defined by Clark County.
- **Soils:** Overall percent cover (using cover classes) of sand, rock, and gypsum/calcareous soils within the plot.

- **Photograph:** Direction and location of the photograph (taken diagonally from one plot corner toward the opposite plot corner).
- **Other Rare Species:** Presence of other rare species as defined by Clark County.
- **Invasive Plants:** Presence of invasive plants as defined by Clark County.
- **Other Comments:** Any other comments deemed appropriate by the surveyors regarding the biology or ecology of the survey plot.

## Target Plant Observations within a Survey Plot

When target plants were encountered within the survey plot, the teams recorded data specific to the population. The following data was recorded for each target plant observation

- **Date of Field Work**: Date the target plant was observed.
- **Target Species Observed:** Identification of target species.
- **Observation Type**: Where the target plant was observed.
- **Approximate Time:** Approximate time the target plant was observed. Recorded concurrently with the GPS data file.
- **Botanist Names:** Names of the Lead Botanist and Assistant Botanist.
- **Geographic Unit:** Unique name assigned to each geographic unit by Clark County.
- **Plant Collection:** Name of the collector and unique collection number.
- **Size of the Population:** Estimated size of the population using size classes.
- **General Aspect:** General aspect within the target species population.
- **Minimum Slope:** Minimum slope within the population.
- **Maximum Slope:** Maximum slope within the population.
- **Cryptogammic Crust:** Presence or absence of cryptogammic crust. Marked as "present" if crust is present within 33% or more of the population.
- **Threats/Disturbance:** Presence of roads (paved or gravel), trails (animal or human), OHV activity, dumping and trash (landscape-level accumulations rather than individual items), and evidence of fire (landscape-level fires) within the population.
- **Vegetation Composition:** Dominant species, co-dominant species (if any are co-dominant), and associate species within the population.
- **Indicator Species:** Presence or absence of seven indicator species defined by Clark County within the population.
- **Soils:** Overall percent cover (using cover classes) of sand, rock, and gypsum/calcareous soils within the population.
- **Photograph:** Description of photographs taken. Types of photographs may include habitat photographs, groups of plants, individual plants, or diagnostic features for the target species in question.
- **Other Rare Species:** Presence of other rare species as defined by Clark County

- **Invasive Plants:** Presence of invasive plants as defined by Clark County.
- **Other Comments:** Any other comments deemed appropriate by the surveyors regarding the biology or ecology of target plant population.

## Incidental Target Plant Observations outside a Survey Plot

In addition to recording target plant observations within designated survey plots, teams recorded incidental observations of target species. Incidental observations included observations of any of the target species made while traveling to or from a survey plot. When target plants were encountered on an incidental basis, the teams recorded data specific to the population in keeping with the methods described above for target plant observations within a survey plot. The following data was recorded for each incidental target plant observation.

- **Date of Field Work**: Date the target plant was observed.
- **Target Species Observed:** Identification of target species.
- **Observation Type**: Where the target plant was observed.
- **Approximate Time:** Approximate time the target plant was observed. Recorded concurrently with the GPS data file.
- **Botanist Names:** Names of the Lead Botanist and Assistant Botanist.
- **Geographic Unit:** Unique name assigned to each geographic unit by Clark County.
- **Plant Collection:** Name of the collector and unique collection number.
- **Size of the Population:** Estimated size of the population using size classes.
- **General Aspect:** General aspect within the target species population.
- **Minimum Slope:** Minimum slope within the population.
- **Maximum Slope:** Maximum slope within the population.
- **Cryptogammic Crust:** Presence or absence of cryptogammic crust. Marked as "present" if crust is present within 33% or more of the population.
- **Threats/Disturbance:** Presence of roads (paved or gravel), trails (animal or human), OHV activity, dumping and trash (landscape-level accumulations rather than individual items), and evidence of fire (landscape-level fires) within the population.
- **Vegetation Composition:** Dominant species, co-dominant species (if any are co-dominant), and associate species within the population.
- **Indicator Species:** Presence or absence of seven indicator species defined by Clark County within the population.
- **Soils:** Overall percent cover (using cover classes) of sand, rock, and gypsum/calcareous soils within the population.
- **Photograph:** Description of photographs taken. Types of photographs may include habitat photographs, groups of plants, individual plants, or diagnostic features for the target species in question.
- **Other Rare Species:** Presence of other rare species as defined by Clark County

- **Invasive Plants:** Presence of invasive plants as defined by Clark County.
- **Other Comments:** Any other comments deemed appropriate by the surveyors regarding the biology or ecology of target plant population.

# Data Processing and Delivery

A Data Management Plan (ICF Jones & Stokes 2009b) was developed for the project, which specified how GPS data would be collected, processed, checked for accuracy, and ultimately delivered to Clark County. GPS data collected in the field was downloaded every day (when possible) and was provided to a Geographic Information System (GIS) specialist for processing using email or other web-based file sharing methods.

GPS data was geo-corrected in the office, saved in a master file geo-database, and validated using a quality control/quality assurance process. Data was delivered to Clark County via CD. Complete metadata was provided with the final data deliverable.

## Data Dictionary

A data dictionary was developed for this project to define the database fields and domains used for field data collection and storage. The data dictionary was loaded onto the GPS units and used by field crews during data collection.

## Aspatial data

Aspatial data was also collected on this project, as described in the Work Plan, and consisted of digital photographs, collected plant specimens, and field data forms (hard copy and scanned), as described below.

### Photographs

During field data collection, a digital photo was taken of each survey plot and of each target plant specimen recorded at each plot. Additional photographs depicting important identification or habitat characteristics were also taken for some species. Field staff renamed each digital photo file at the end of each survey day using the following naming conventions:

**Plot photographs:** <Geographic Unit>-<PlotNumber>.jpg,
*example:* **G-23.jpg** would be the plot photograph for Gold Butte, plot 23.

**Target plant photographs within a survey plot:** <Geographic Unit>-<PlotNumber>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>.jpg
*example:* **G-23-AC-2.jpg** would be the second photograph of *Arctomecon californica* found in Gold Butte, Plot 23.

**Target plant photographs observed incidentally:** <Geographic Unit>-<Nearest Plot Number and Incidental (abbreviated to "I")>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>,
*example:* **G-23I-AC-2.jpg** would be the second photograph of *Arctomecon californica* found incidentally in Gold Butte on the way to or from Plot 23.

## Plant Specimens

Field crews collected voucher specimens of observed target plants for delivery to Clark County according to the requirements/limitations outlined in the applicable permits for the project. Certain limitations on collection were established in the permits to account for population size. Voucher specimens were preserved in the field using a standard botanical plant press. Field crews used standard professional judgment in collecting the appropriate material for an herbarium sheet and for identification purposes. Each specimen was given the collector's unique identification number (if applicable), and each plant specimen was uniquely identified using the naming conventions shown below.

**Target plant specimens within a survey plot:** <Geographic Unit>-<PlotNumber>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>
*example:* RG-23-PC-2 would be the second voucher specimen of *Pediomelum castoreum* found in Rainbow Gardens Plot 23.

**Target plant specimens observed incidentally:** <Geographic Unit>-<Nearest Plot Number and Incidental (abbreviated to "I")>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>
*example:* **RG-23I-PC-2** would be the second voucher specimen of *Pediomelum castoreum* found incidentally in Rainbow Gardens on the way to or from Plot 23.

Pressed and labeled specimens were delivered to the ICF J&S office (in person or by delivery service) as soon as practicable following collection. Specimens were used by the ICF J&S team as necessary to verify identifications. Once identifications were accepted by the team, the specimens were delivered to Clark County as appropriate for the data deliverables either in person or by delivery service.

## Hard Copy Data Forms

Field crews recorded information on survey plots and on observed target plant populations on hard copy data forms. The completed hard copy forms were scanned at the ICF Jones & Stokes office and saved as electronic image files (pdf files) using the naming convention shown below.

**Survey Plot Form:** <Geographic Unit>-<PlotNumber>.jpg,
*example:* **RG-23.pdf** would be the plot data form for Rainbow Gardens, plot 23.

**Target plant data forms within a survey plot:** <Geographic Unit>-<PlotNumber>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>.jpg
*example:* **RG-23-PC-2.pdf** would be the second population of *Pediomelum castoreum* found in Rainbow Gardens Plot 23.

**Target plant data forms for plants observed incidentally:** <Geographic Unit>-<Nearest Plot Number and Incidental (abbreviated to "I")>-<PlantCode (=first letter of genus, first letter of species name)>-<sequence number (if necessary)>
*example:* **RG-23I-PC-2.pdf** would be the second observation of *Pediomelum castoreum* found incidentally in Rainbow Gardens on the way to or from Plot 23.

# Data Accuracy and Quality

This section describes the data Quality Assurance/Quality Control (QA/QC) procedures implemented during the project.

## Standardization of Data Collection

A data dictionary was developed and installed on the GPS units, to control the type and content of attribute data collected. Data was entered into the unit through use of electronic forms, pulldown menus, and data domains.

Instructions for data collection protocols and procedures were provided in a project Work Plan, which was distributed to each field crew member. In addition, on-site training and calibration for field crews was completed prior to field surveys, which covered operation of the GPS units, collection of location and attribute data, and upload of collected data.

## Standardization of Data Management

The collected data was processed to a point where it is stored in ESRI File Geodatabase (FGDB) formats registered to UTM Zone 11 NAD 1983 meters coordinates.

## Post-Collection Data Verification Methodologies

The GIS Analyst performed post-processing and verification of all field collected data. The following QC steps were performed for each data set.

1. Data Transfer: A field data collection effort creates a set of raw GPS files. Field crew leaders used Trimble Pathfinder Office software to transfer the raw files from the GPS unit to a laptop computer, creating a single SSF file. Alternatively, crew leaders, when using appropriate GPS units, were able to store data on an SD card and transfer the raw files from the SD card to a laptop, creating an SSF file. The crew member then uploaded the data to the ICF Jones & Stokes server. Crew members performed a visual check of transferred and uploaded data files to validate the following conditions.
    a. All expected files have been transferred.
    b. The file sizes look appropriate (e.g. no zero file sizes).
2. Data geo-correction: The GIS Analyst copied the uploaded data (SSF files) to the GIS server and geo-corrected the data. This process generated a quality report as a text file that describes the parameters used and the resulting horizontal accuracy of the data. The GIS Analyst inspected this report and noted any suspect values. The text file was retained and filed.
3. The GIS Analyst used Trimble Pathfinder Office software to create a shapefile.
4. The GIS Analyst used ArcGIS to save the data as feature classes in the master file geodatabase.
5. The survey plot and observation data points were visually inspected in ArcMap to validate the following conditions.
    c. Location check: All data points fell within the expected geographic unit polygon (or, in the case of Incidental data, within the expected proximity).

d. Attribute check: All expected attribute fields were populated.

6. When incidental observations were recorded along roadsides (vehicular observations), the GIS analyst clipped them from the main database and saved them as separate shapefiles. All vehicular observations were retained as separate shapefiles during the project and were delivered to Clark County at the conclusion of the project using the data delivery protocol described in the data management plan.
7. Problems: If the GIS Analyst noted an error, omission, or question regarding a data point, s/he notified the lead surveyor and/or Project Manager by email for resolution. If necessary, the GIS Analyst edited the feature class to fix any problems.
8. Biology Checks: A lead botanist reviewed the data to ensure that all fields were complete and appropriate (e.g., *Larrea tridentata* is not listed as both a dominant and an associate in the vegetation composition fields for a single plot). S/he also selected a 20% sample of the plots at random and verified that all the data are consistent with the hard copy field data forms. If, upon review of the hard copy field data forms, 20% or more of the plot data contained inconsistencies or errors, then 100% of the data (for each data deliverable) was reviewed for consistency with the hard copy field data forms.
9. Federal Geographic Data Committee (FDGC) compliant Metadata was created.

A QC checklist was maintained by the GIS Analyst to record the QC steps completed with each dataset.

## Transfer of Data and Metadata

The electronic data collected and processed for this project was transmitted to the County on a regular schedule in packages of 42–44 survey sites. Each data package included the following files:

- An ESRI File Geodatabase of the surveyed locations and their attributes, including metadata, compressed into a single zip file.
- A set of digital photos in jpeg format of the survey plots and observed target plants.
- A set of digital scanned images in pdf format of the hard copy completed data forms for the survey plots and observed target plants.
- A one-page transmittal sheet in pdf format describing the contents of the deliverable package.

Each data package was burned to a CD (or DVD) and then delivered to Clark County by courier or other means.

# Results

Field surveys were initiated on April 2, 2009 and concluded on May 23, 2010, a period of approximately 13 months. The majority of surveys, approximately 80%, were conducted in April and May 2009. Higher elevation areas, and areas which could not be surveyed in spring 2009 (because of limitations on access, inappropriate flowering periods, etc.) were surveyed in the summer of 2009 and the spring of 2010. Overall, a total of 86 field survey days were required to complete the project. The project resulted in the observation of all ten target plant species (Table 3).

**Table 3. Target Rare Plants and Survey Results**

| Scientific Name | Common Name | Number of Observations* |
|---|---|---|
| *Anulocaulis leisolenus* | Sticky ringstem | 4 |
| *Arctomecon californica* | Las Vegas bearpoppy | 31 |
| *Arctomecon merriamii* | White bearpoppy | 13 |
| *Astragalus geyeri* var. *triquetrus* | Threecorner milkvetch | 9 |
| *Eriogonum bifurcatum* | Pahrump Valley buckwheat | 3 |
| *Eriogonum corymbosum* var. *nilesii* | Las Vegas buckwheat | 3 |
| *Eriogonum viscidulum* | Sticky buckwheat | 5 |
| *Pediomelum castoreum* | Beaver Dam breadroot | 25 |
| *Penstemon albomarginatus* | White margined beardtongue | 1 |
| *Penstemon bicolor* ssp. *bicolor* | Yellow tow-tone beardtongue | 4 |

*Number of observations includes observations made while on foot. Observations made from a moving vehicle were reported to the DCP project manager but are not included in this report.

Data was collected on threats and disturbances at each plot location during the project. OHV activity was commonly encountered. Other disturbances, such as the presence of roads, trails, dumping and trash, and evidence of fire, were much less common but were occasionally observed within survey plots. Data was also collected on threats and disturbances for each target plant observation location. Overall, evidence of disturbance was relatively infrequent for most target plants. For some species, such as Las Vegas bearpoppy and sticky ringstem, evidence of trails or OHV use was more common. While conclusions based on this survey, and relatively small number of occurrence observations, are difficult, the authors of this report theorize that those habitats are more likely to be disturbed because of characteristics that make them easier to navigate in a OHV (i.e., open mostly unvegetated soils, lack of large rocks, soft soils, etc.).

A total of 98 target plant observations were made during the project. Approximately 40% of all observations were incidental (i.e., observations made when traveling to or from the survey plot). A brief summary of the survey results for each species are provided below.

## Sticky Ringstem

Sticky ringstem was located four times during the surveys. It was recorded two times within the survey plot, and two times incidentally when traveling to or from the survey plot. Representative photographs of sticky ringstem are provided in Appendix A.

## Las Vegas Bearpoppy

Las Vegas bearpoppy was located thirty-one times during the surveys. It was recorded seventeen times within survey plots, and fourteen times incidentally when traveling to or from the survey plot. Representative photographs of Las Vegas bearpoppy observed during the surveys are provided in Appendix A.

## White Bearpoppy

White bearpoppy was located thirteen times during the surveys. It was recorded nine times within survey plots, and four times incidentally when traveling to or from the survey plot. Representative photographs of white bearpoppy observed during the surveys are provided in Appendix A.

## Threecorner Milkvetch

Threecorner milkvetch was located nine times during the surveys. It was recorded seven times within survey plots, and twice incidentally when traveling to or from the survey plot. Representative photographs of threecorner milkvetch observed during the surveys are provided in Appendix A.

## Pahrump Valley buckwheat

Pahrump Valley buckwheat was located three times during the surveys. It was recorded seven times within survey plots, and twice incidentally when traveling to or from the survey plot. Representative photographs of Pahrump Valley buckwheat observed during the surveys are provided in Appendix A.

## Las Vegas Buckwheat

Las Vegas buckwheat was located three times during the surveys. It was recorded twice within survey plots, and once incidentally when traveling to or from the survey plot. Representative photographs of Las Vegas buckwheat observed during the surveys are provided in Appendix A.

## Sticky Buckwheat

Sticky buckwheat was located five times during the surveys. It was recorded four times within survey plots, and once incidentally when traveling to or from the survey plot. Representative photographs of sticky buckwheat observed during the surveys are provided in Appendix A.

## Beaver Dam Breadroot

Beaver dam breadroot was located twenty-five times during the surveys. It was recorded sixteen times within survey plots, and nine times incidentally when traveling to or from the survey plot. Representative photographs of beaver dam breadroot observed during the surveys are provided in Appendix A.

## White Margined Beardtongue

White margined beardtongue was located only once during the surveys within a survey plot. Representative photographs of white margined beardtongue observed during the surveys are provided in Appendix A.

## Yellow Two-tone Beardtongue

Yellow two-tone beardtongue was located four times during the surveys. It was recorded twice within survey plots, and twice incidentally when traveling to or from the survey plots. Representative photographs of yellow two-tone beardtongue observed during the surveys are provided in Appendix A.

## Other Rare Plants

Although not the focus of this project, several other rare plant species were also located during the field surveys, including Palmers phacelia (*Phacelia palmeri*), Parish phacelia (*Phacelia parishii*), and silverleaf sunray (*Enceliopsis argophylla*).

# Conclusion and Recommendations

All target plant species were observed at least once during the course of the surveys. Las Vegas bearpoppy was the most commonly observed target species with 31 observations, and white-margined beardtongue was the least, observed only once. A majority of the observations were made within the survey plots, however approximately 40% of all observations were incidental (i.e., the observations were made traveling to or leaving the survey plot). Many of the target species are perennial and/or have distinctive habitats and/or growth forms; factors that make the survey results very reliable. The remaining annual species are known to be highly dependent on the timing and abundance of rainfall. Rainfall during the winter of 2008 and spring of 2009 was close to normal and all the annual species were evident at reference populations, indicating the results of the surveys should also be reliable for annual species. In conclusion, the survey results from this study should be considered very reliable for all species given this information.

In general, the methods employed to implement this project worked very well. The 30-foot transect spacing implemented as part of the project is adequate to detect all ten target species. The use of the "between feature tracking" setting on the GPS unit worked very well overall and provides a good record of the survey areas. The custom data dictionary and pre-project training allowed for standardized data collection. No recommendations relating to the survey methodology are evident at this time.

# Literature Cited

ICF Jones & Stokes. 2009a. *Desert Conservation Program Rare Plant Inventory Work Plan*. April. (ICF J&S Project 00272.09.) Sacramento, CA. Prepared for: Clark County Desert Conservation Program, Nevada.

ICF Jones & Stokes. 2009b. *Desert Conservation Program Rare Plant Inventory Data Management Plan*. April. (ICF J&S Project 00272.09.) Sacramento, CA. Prepared for: Clark County Desert Conservation Program, Nevada.

# Preparers

The following individuals assisted with this survey project:

Brad Schafer- Project Manager/Lead Botanist

Margaret Widdowson- Botanist

Marc Baker- Botanist

Robert Preston-Botanist

Bruce Lund- Botanist

Brant Primrose- Botanist

Makela Mangrich- Botanist

Cristian Singer- Botanist

Frank "Buddy" Smith- Botanist

Yancy Bissonette- Botanist

Korey Klutz- Botanist

John Holson-Botanist

Laurel Anderton-Botanist

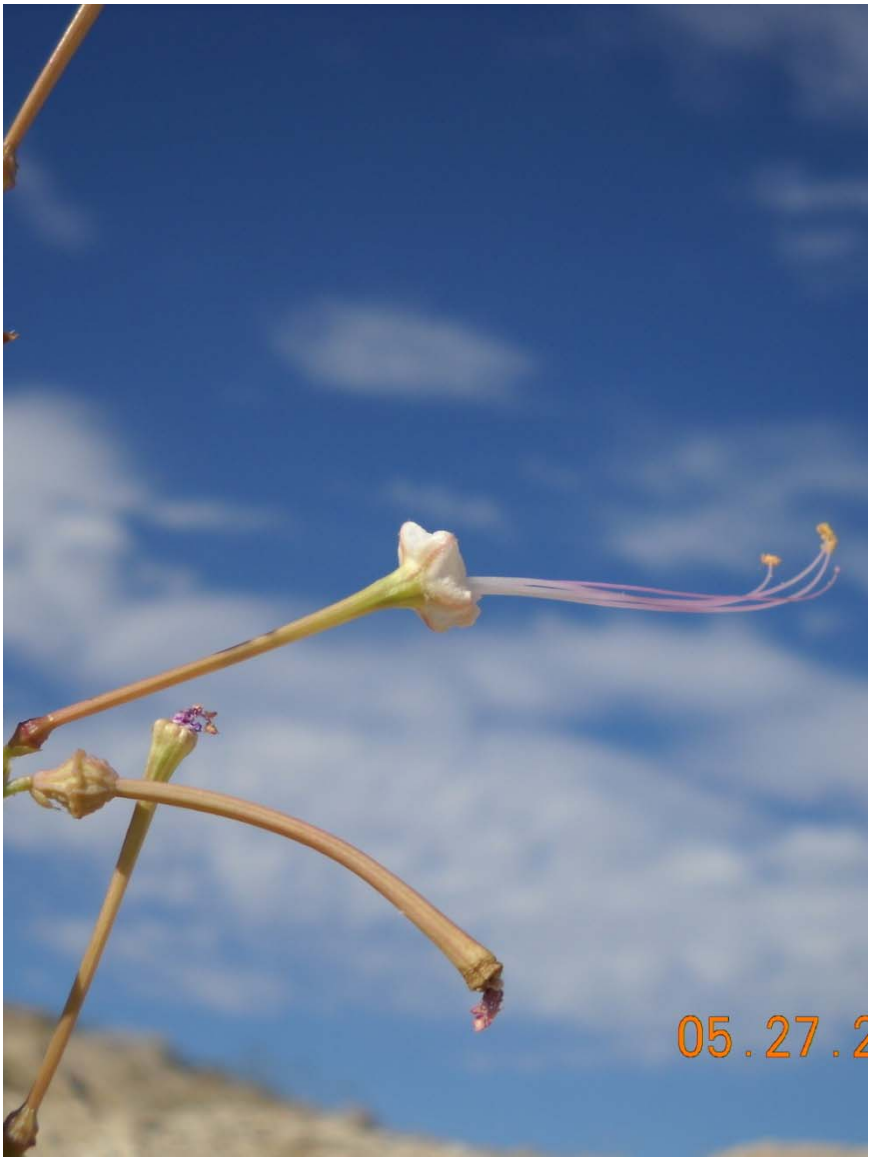
Seth Kirby-Botanist

Daniel Schiff- GIS Specialist

Daniel Moreno- GIS Specialist

Appendix A

# Photographs




**Sticky Ringstem**

**Las Vegas Bearpoppy**

**White Bearpoppy**

**Threecorner Milkvetch**


**Pahrump Valley Buckwheat**

**Las Vegas Buckwheat**

**Sticky Buckwheat**

**Beaver Dam Breadroot**

**White Margined Beardtongue**

**Yellow Two-toned Beardtongue**